

Importance of Black Carbon to the Bioavailability of PAHs to Marine Species

A Regional Methods Initiative/Biological Advisory Committee (RMI/BAC) Project



U.S. EPA
ORD/NHEERL

Atlantic Ecology Division
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The Problem:

- Polycyclic Aromatic Hydrocarbons (PAHs) are one of the most abundant anthropogenic organic contaminants in the environment
- PAHs demonstrate several modes of toxicity including lethality and carcinogenicity
- Over the last 10 years, recognition of the presence of black carbon in the environment has changed our understanding of PAH geochemistry and bioavailability
- Black carbon forms during the burning of organic carbon (e.g., fossil fuels and biomass)
- Uncertainty exists in our understanding of how black carbon affects PAH bioaccumulation by marine benthic organisms
- These organisms serve as the base of the marine food web and serve as prey for larger organisms eaten by fish, wildlife, birds and humans

What's Next...

- Several researchers around the world are investigating the significance of black carbon on the geochemistry and bioavailability of organic contaminants including PAHs, PCBs and dioxins
- Regional and State regulators should consider the effects of black carbon on bioaccumulation at their sites

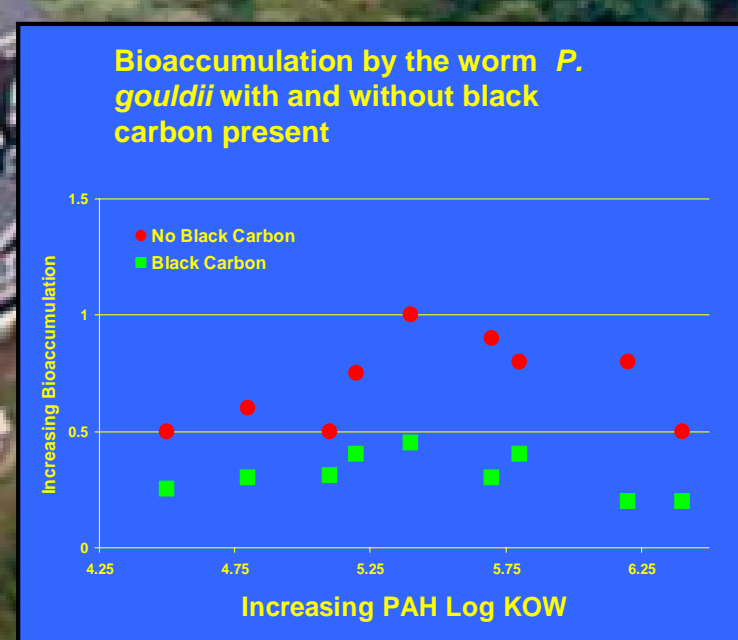
Products:

- Data for use in two EPA documents for evaluating risk associated with PAHs
 - U.S. EPA, 2004, Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures, EPA 600/R-02/013
 - U.S. EPA, *in press*, Procedures for the Derivation of Site-Specific Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Nonionic Organics, EPA 600/R-02/012
 - * Available at <http://www.epa.gov/nheerl/publications/>
- Several papers published in the peer-reviewed literature
 - Symposium series in the journal *Environmental Toxicology and Chemistry*
 - November 2004 issue

Project Objective:

Investigate the importance of black carbon to the bioaccumulation of PAHs by marine benthic organisms

- Compare conventional two phase bioaccumulation model which considers only natural particles to a new multiple phase model that considers natural particles and black carbon particles



Findings:

- Presence of black carbon reduced the bioaccumulation of PAHs by marine benthic organism
 - Depending on type of organism
 - Depending on type of PAH
- Multiple phase model improved predictions of PAH bioaccumulation by marine benthic organisms
 - Two phase model was more variable

Project Approach:

- Perform field and laboratory studies investigating the effects of black carbon on PAH bioaccumulation by several marine benthic species:

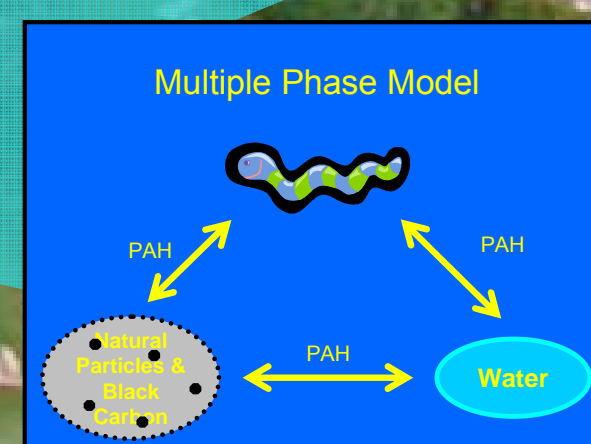
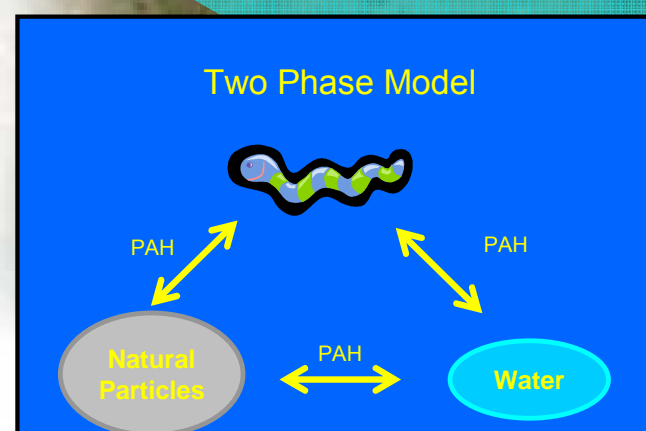
- Bivalves



- Worms



- Evaluate whether the conventional two phase model or new multiple phase model is most accurate for predicting PAH bioaccumulation



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